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- 45 Minutes, No materials allowed. (number) indicates weighting.

1. How do we 2's complement a hex number? Please describe two ways using "73A16". (0.5)

0.3  
You can convert to binary two's complement then convert back to hex or you can subtract each hex digit from F and then add 1. show

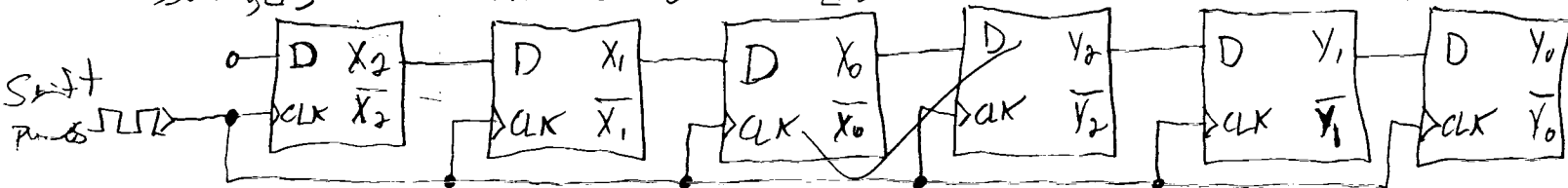
2. Implement the expression  $AB + \overline{A}\overline{B}$  using only one gate. (0.5)

XNOR  $A \oplus B$

A	B	
0	0	1
0	1	0
1	0	0
1	1	1

3. Show two three-bit shift registers connected so that the contents of the X register will be serially transferred (shifted) into register Y using D flip-flops for each shift register. If original value of X register is "101", what is the content of Y registers after second pulse? (1)

Assuming  $[Y] = 000$  at start contents of  $[Y]$  will be 010 after second pulse



4. A certain memory has a capacity of  $128K \times 8$ . (a) How many data input and data output lines does it have? (b) How many address lines does it have? (c) What is its capacity in bytes? (1.5)

a) it will have 8 data o/p/i/p lines as its word size is 8

b) It will have  $2^{17} = 128K$  17 address lines

c) Its capacity in bytes is  $128K$  b/c each word is 8 bits or 1 byte long and it can hold  $128K$  words.

5. It is desired to combine several  $2K \times 8$  PROMs to produce a total capacity of  $16K \times 8$ . How many PROM chips are needed? How many address lines are required? Provide address range for each PROMs in Hex. (1.5)

0.5  
You will need 8 PROM chips. You will require 14 address lines consisting of 3 lines going to a 3 to 8 decoder to select which chip and 11 lines to select the address from the chip  $2^{14} = 16384$ .

1 2 3 4 5  
0000 - 07FF, 0800 - 0FFF, 1000 - 17FF, 1800 - 1FFF, 2000 - 27FF

6 Department of Electrical Engineering, University of Saskatchewan  
2800 - 2FFF, 3000 - 37FF, 3800 - 3FFF